242. Proposed by J. H. MEYER, S. J., Augusta, Ga.

A given sphere is to be formed into a solid composed of two equal cones on opposite sides of a common base, in such a manner that its surface may be the least possible. Find the dimensions of the solid, and compare its surface with that of the sphere.

Solution by A. H. HOLMES, Brunswick, Maine.

Of the cones into which the given sphere, radius R, is to be transformed, let x=radius of base, and y=altitude.

Then $\frac{2\pi x^2 y}{3}=\frac{4\pi R^3}{3}$ or $x^2y=2R^3$ a minimum, or

$x^4+\frac{4R^6}{x^2}$=a minimum.

$\therefore 4x^3=\frac{8R^6}{x^3}$, and therefore $x=2^{\frac{1}{6}}R$ and $y=2^{\frac{2}{3}}R$.

Put S_1=surface of sphere, and S_2=surface of required solid.
Then $S_1:S_2=4:2^{\frac{4}{3}}\sqrt{3}$.

Also solved by G. B. M. Zerr.

MECHANICS.

188. Proposed by H. L. ORCHARD, M. A., B. S.

Spherical bubbles of air are rising in water. Find the relation between radius and velocity.

Solution by G. B. M. ZERR, A. M., Ph. D., 4243 Girard Avenue, Philadelphia, Pa.

Let R=radius of bubble at surface of water, r=radius of bubble at start at bottom, δ=density of gas in bubble referred to water as unity, w= weight of one cubic inch of water in pounds, h=height of column of water equal to weight of one atmosphere, d=depth of water where bubble starts, v=velocity of bubble at distance s from starting point, bubble starting from rest, x=radius of bubble at distance s from starting point, f=acceleration.

$\therefore \frac{4}{3}\pi R^3 w\delta$=weight of gas in pounds, $\frac{4}{3}\pi R^3 w$=force, in pounds, impelling bubble upwards.

$\therefore f=\frac{\frac{4}{3}\pi R^3 w(1-\delta)g}{\frac{4}{3}\pi R^3 w(1+\delta)}=\frac{(1-\delta)g}{1+\delta}$. $\therefore v^2=2fs$. Also $h+d:h+d-s=x^3:r^3$.

$\therefore s=\frac{(x^3-r^3)(h+d)}{x^3}$. $\therefore v^2=\frac{2f(x^3-r^3)(h+d)}{x^3}$.